Waterfront Toronto - Risk Management Measures for the New River Valley

David Bertrand
Geosyntec Consultants

SMART Remediation
Toronto, ON | January 23, 2020

1

Outline

- Project Overview and Background
- Project Challenges
- River Valley Design Objectives
- Data Compilation and Modelling
- River Valley Risk Management Measures
- Information Management

2

Overview: The Port Lands: Flood Protection and Redevelopment

- $1.25-billion flood-protection project in Toronto's Port Lands district
- Largest urban redevelopment project currently underway in North America
- 100-hectares (~250 acres) of contaminated property
- Redevelopment includes
  - Building a new river valley and re-naturalizing the mouth of the river
  - Environmental risk management measures

3

Past Site Use

Port Lands, 1970s

City of Toronto Archives

4

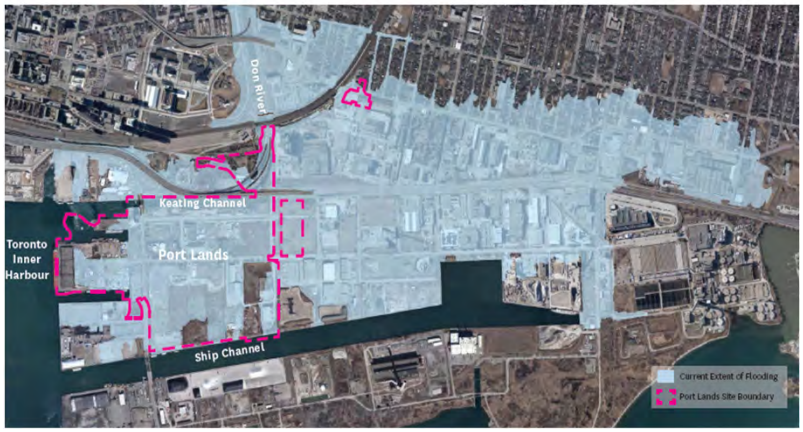
Courtesy of MVVA, 2019

Hurricane Hazel

In 1954 Hurricane Hazel caused massive flooding and property loss in Toronto

5

Providing Flood Protection for 300 Hectares of Downtown Toronto

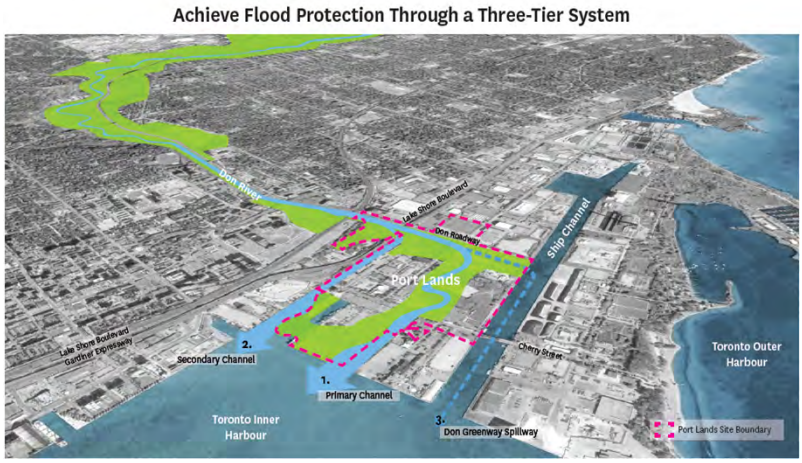


Courtesy of MVVA, 2019

Port Lands Flood Protection

6

Port Lands Flood Protection



Courtesy of MVVA, 2019

7

Waterfront - Future

Courtesy of MVVA, 2019

8

Project Challenges

- Construct river through a heavily contaminated area
- River finishes to be constructed in the dry
- Significant volume debris from past construction
- Aggressive construction schedule

9

River Valley Design Objectives

- **Hydraulic Control During Construction**
  - Limit amount of dewatering and water treatment required
  - Facilitate construction of horizontal RMM barrier and River finishes under dry conditions
- **Risk Management Measures**
  - Long-term protection of surface water, visitors, workers, and ecosystems from future contaminant transport (dissolved and free phase)

Design: Vertical Cutoff Wall and Horizontal Barrier

10

PLFP Work Package 3 and 6 Areas
Waterfront Toronto
Michael Van Valkenburgh Associates, Inc., Landscape Architects
03 May 2019

River Valley Works Areas

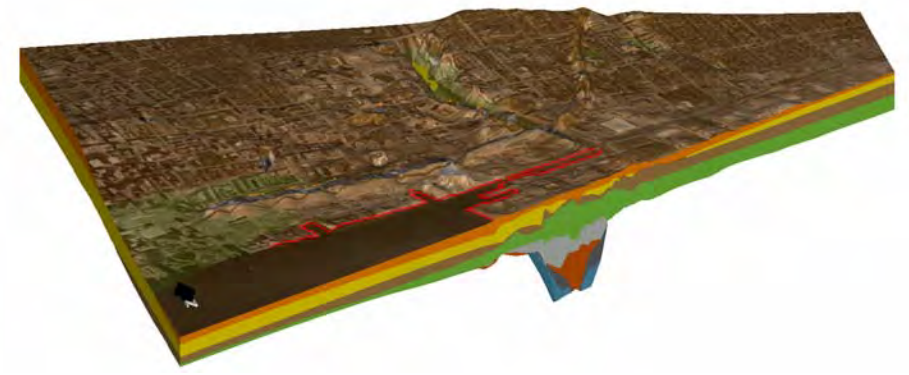
11

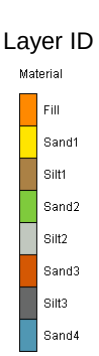
3D Geologic Model

- Compiled boring log control points
  - Geotechnical and Environmental borings
  - Ontario Geological Survey
  - Ontario Water Well Information System
- Reviewed and eliminated erroneous/anomalous data points
- Classified data based on observed geology
- Established bedrock and ground surface topography
- Formatted data in preparation for 3D modeling

12

Stratigraphic Model





13

Contaminant Distribution

Contaminant Plume Legend

Petroleum Hydrocarbons (analytical data) > 8,000 mg/kg

Petroleum Hydrocarbons (inferred by LIF data) > 8,000 mg/kg

Sample Legend

Analytical PHC > 8,000 ppm

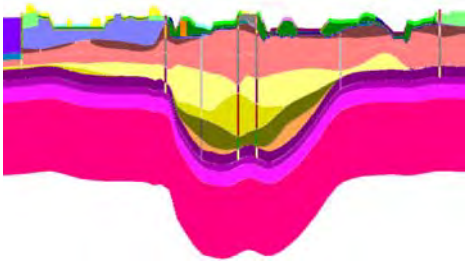
LIF PHC > 8,000 ppm

Analytical or LIF PHC < 8,000 ppm

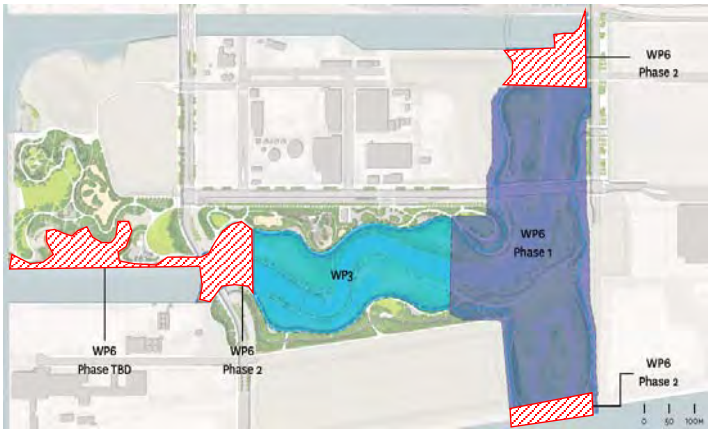
14

Groundwater Model

- Simulate groundwater flow conditions to:
  - evaluate design assumptions
  - assess potential for groundwater mounding
  - assess potential impact on dissolved phase and free phase petroleum hydrocarbons
  - assess changes in flow paths to inform long term monitoring



15

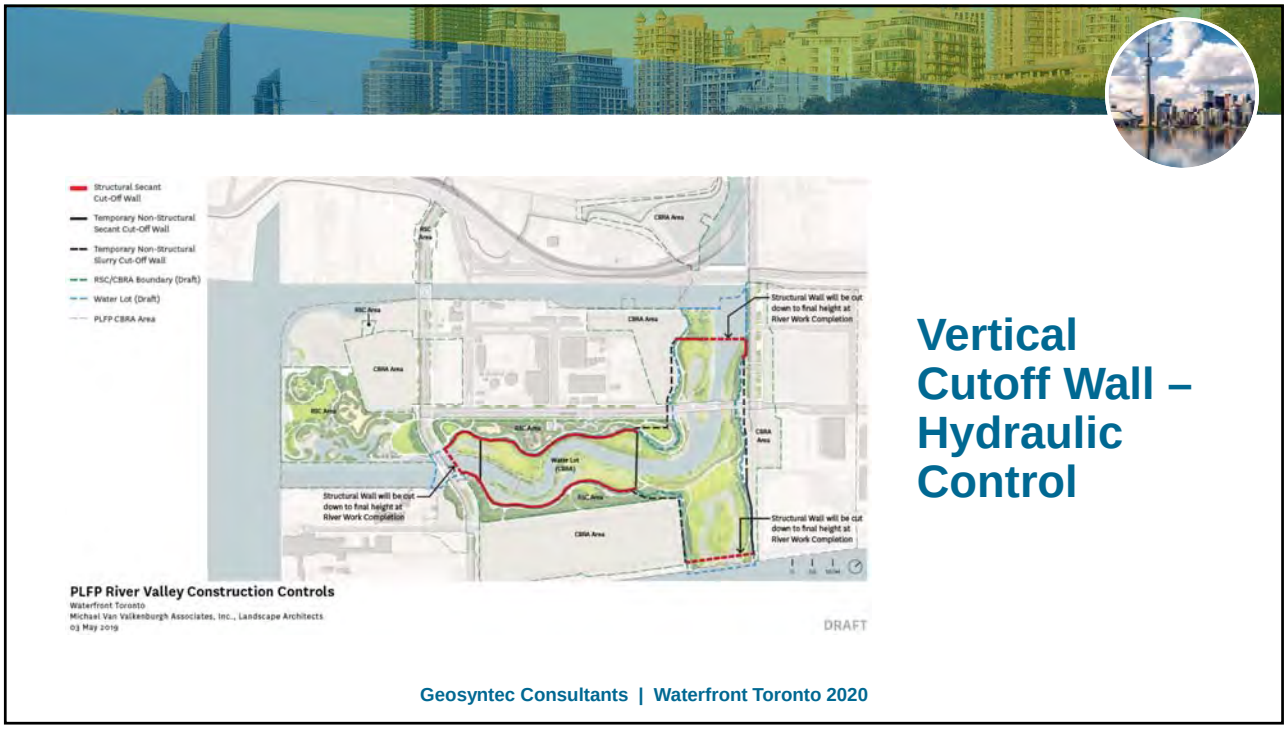


Courtesy of MVVA, 2019

Design Considerations

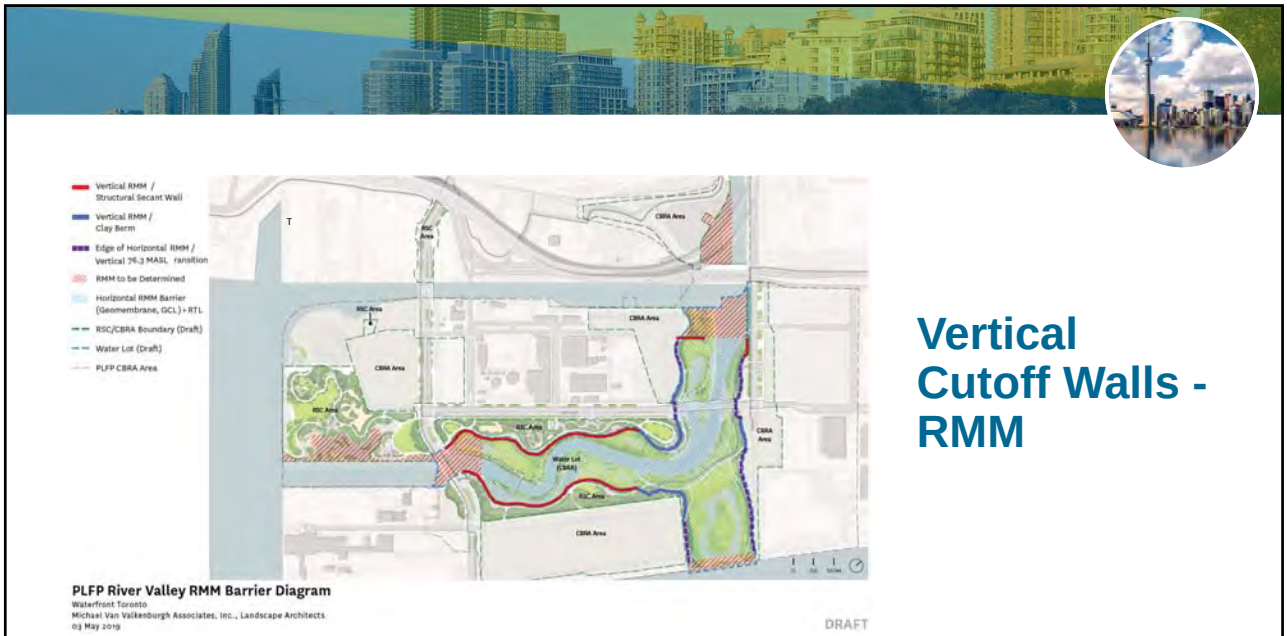
- Construction sequencing and scheduling
- Roadway and bridge relocations
- Work in the wet vs. work in the dry
- High water treatment costs

16



Vertical Cutoff Wall – Hydraulic Control

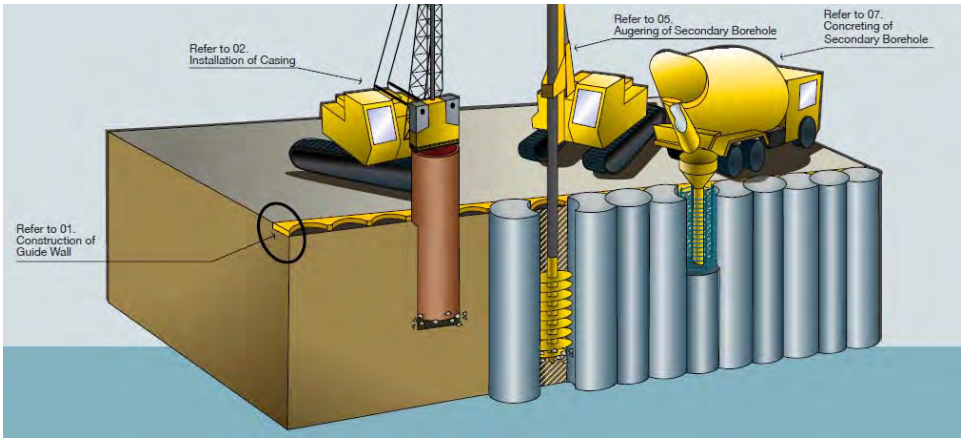
17



Vertical Cutoff Walls - RMM

18

Vertical Cutoff Wall Design: Secant Piles



19

Cutoff Wall Construction

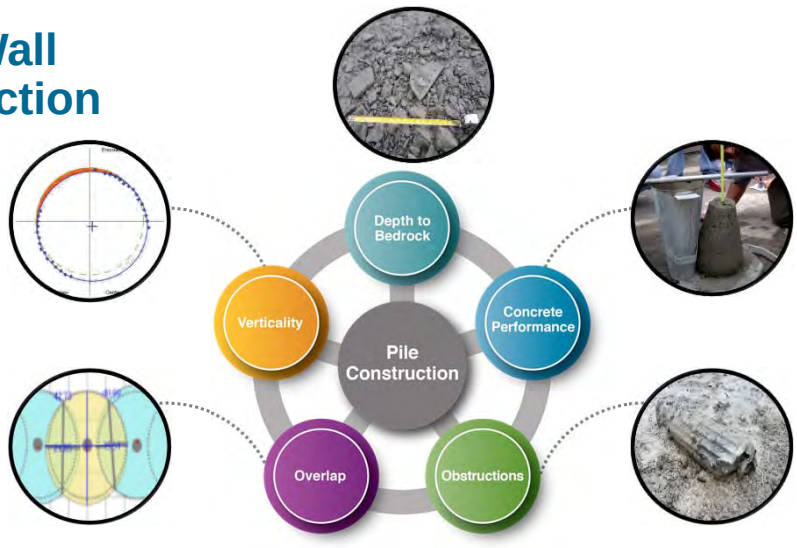
20

Cutoff Wall Construction



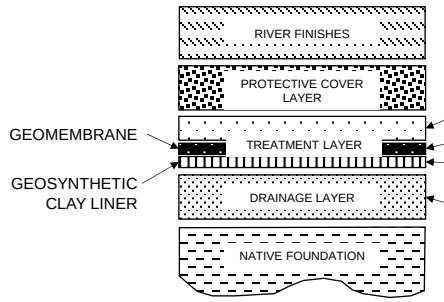

21

Cutoff Wall Construction

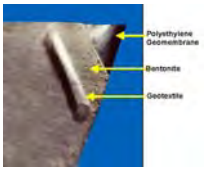


22

Horizontal Barrier

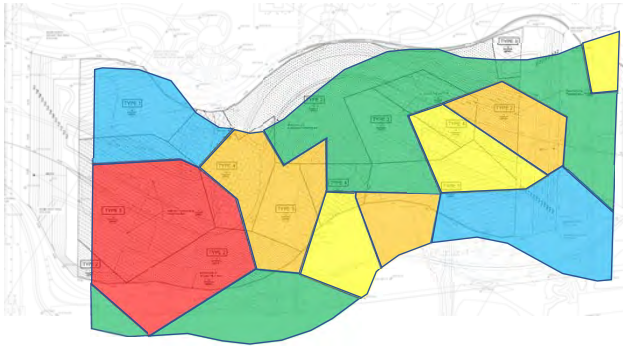


- Required contingency supplementary to Geomembrane and Geosynthetic Clay Liner
- 60-mil HDPE geomembrane primarily governed by long-term longevity and chemical compatibility
- 1.5-cm bentonite GCL liner
- Primary hydrologic and physical barrier isolating the underlying impacts from proposed river finishes
- Facilitates collection of any potential seepage water contacting the GCL and premature hydration during barrier placement
- Mechanism for keeping excavation dry



23

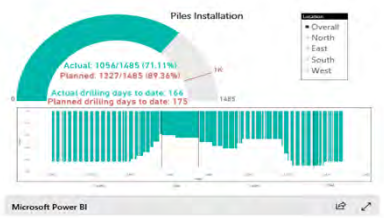
Reactive Treatment Layer Zones

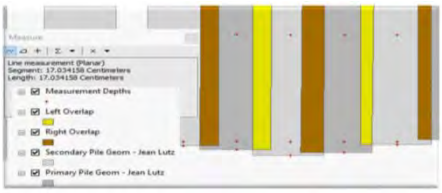


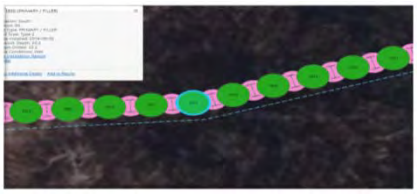
- Carbon dosage corresponds to max groundwater concentrations under Horizontal Barrier
- Granular activated carbon
- Groundwater dissolved phase breakthrough criteria based on accepted aquatic protection values

24

Information Management System

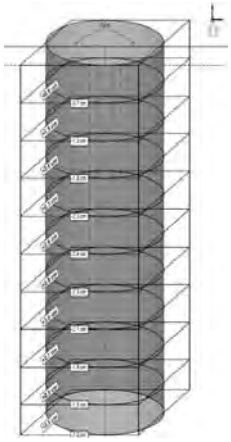


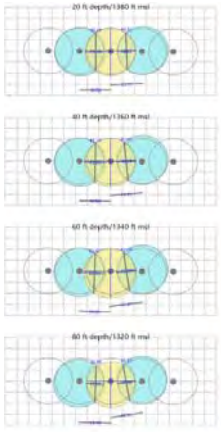


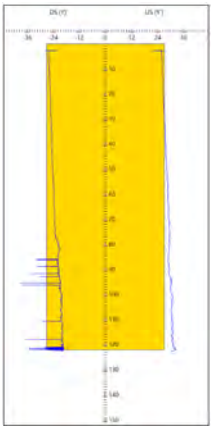


25

Information Management System - Verticality







Tools for visualizing interlock of secant piles

26

Acknowledgments

Waterfront Toronto

- Meggen Janes, Don Forbes & Joey Herrington

Michael Van Valkenburgh Associates Inc.

- Laura Solano & James Smith

Geosyntec

- Danielle Thorson, Howard Cumberland, David Bonnett & Chris Robb